IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicants: Jill MacDonald Boyce | Examiner: An, S.

Serial No: 10/529,711 | Group Art Unit: 2621

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For: IMPLICIT WEIGHTING OF REFERENCE PICTURES IN A VIDEO ENCODER

Mail Stop Appeal Brief-Patents
Hon. Commissioner for Patents
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REPLY BRIEF

Applicants provide this Reply Brief in response to the Examiner's Answer dated February 13, 2008.

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1. Status of Claims

Claims 1-14 are pending. Claims 1, 3-9, 11, and 13-14 stand rejected and are under appeal. Claims 2 and (10, and 12) have been objected as being dependent upon rejected base Claims 1 and 9, respectively, but would be allowable: if Claim 2 is rewritten in independent form including all of the limitations of the base claims 1 and any intervening claims; and if either Claim 10 or Claim 12 is rewritten in independent form including all of the limitations of the base Claim 9 and any intervening claims.

A copy of the Claims 1-14 have been presented in Section 8 of the Appeal Brief.

2. Grounds of Rejection to be Reviewed on Appeal

Claims 1, 3-9, 11, and 13 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,081,551 to Etoh (hereinafter "Etoh") in view of U.S. Patent No. 4,663,665 to Tanaka et al. (hereinafter "Tanaka"). Moreover, Claim 14 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Etoh and Tanaka as applied to Claim 9, and further in view of U.S. Patent No. 6,782,054 to Bellers (hereinafter "Bellers"). The preceding rejections are presented for review in this Appeal.

Regarding the grouping of the Claims, Claims 3-8 stand or fall with Claim 1, and Claims 11 and 13-14 stand or fall with Claim 9, due to their respective dependencies. As noted above, Claims 2, 10, and 12 have been objected to, but deemed allowable.

3. Argument

A. Introduction

In general, the present principles are directed to implicit weighting of reference pictures in a video encoder (Applicants' Specification, Title). As disclosed in the Applicants' specification, the present invention is directed to weighting factors, since, "in some video sequences, particularly those with fades, the current picture to be coded or decoded is more strongly correlated with the reference picture scaled by a weighting factor than with the reference picture itself" (Applicant's specification, p. 1, lines 20-22). Moreover, "[w]hen weighting factors are used in encoding, a video encoder needs to determine both the weighting factors and motion vectors" (Applicant's specification, p. 3, lines 3-5).

Accordingly, the present principles provide a novel approach to calculating implicit weighting factors, wherein the distances of the current picture from the reference picture(s) are used to determine the relative weighting factors (Applicant's specification, e.g., p. 5, lines 25-30, and p. 9, lines 10-14).

The claims of the pending invention include novel features not shown in the cited references and that have already been pointed out to the Examiner.

It is respectfully asserted that Claims 1, 3-9, 11, and 13-14 are patentably distinct and non-obvious over the cited references, as will be shown herein below. As such, Claims 1, 3-9, 11, and 13-14 are presented for review in this appeal.

B. Rejection Under 35 U.S.C. §103(a) Over U.S. Patent No. 6,081,551 in view of U.S. Patent No. 4,663,665

"To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art" (MPEP §2143.03, citing *In re Royka*, 490 F.2d 981,

180 USPQ 580 (CCPA 1974)). "If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious" (MPEP §2143.03, citing *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)).

The Examiner rejected Claims 1, 3-9, 11, and 13 as being unpatentable over U.S. Patent No. 6,081,551 to Etoh in view of U.S. Patent No. 4,663,665 to Tanaka et al. The Examiner contends that the combination of Etoh and Tanaka shows all the elements recited in these claims.

Etoh is directed to image coding and decoding apparatus and methods thereof (Etoh, Title). To that end, Etoh discloses, in the Abstract thereof, an apparatus that comprises the following:

> motion detecting means for detecting a motion vector for each block of a prescribed size from a reference image and an input image; weighted motion compensation means for, based on the detected motion vector, extracting from the reference image an area of a prescribed size which is wider than the prescribed block size and which contains an area corresponding to each block of the input image, and for creating a predicted image for the input image by applying a predetermined weight to each of pixels in the wider area and by using the weighted pixels of the wider area; a predicted-image memory for storing the predicted image; encoding means for taking a residual between the stored predicted image and the input image, and for encoding the residual; and decoding means for decoding the encoded image data and thereby obtaining a reference image.

Tanaka is directed to a TV system conversation apparatus (Tanaka, Title). To that end, Tanaka discloses the following in his Abstract:

> The picture quality deterioration such as judder caused by TV frame number conversion can be mitigated by selecting either the stationary original picture signal or the motion-compensated interpolated picture signal based on the most adaptive motion vector corresponding to the smallest interframe difference between the original picture signal and the motion-compensated picture signals based on the motion vectors individually detected from divisional picture areas. The effect of this mitigation can be increased by weighting the detected motion vectors and by smoothing the contour between motion-compensated picture areas with the aid of filtering.

It will be shown herein below that the limitations of the Claims 1 and 9 reproduced herein are not shown in Etoh and/or Tanaka, and that such Claims should be allowed including those dependent there from as identified in Section 2 herein.

B1. Claims 1, 3-9, 11, and 13-14

It is respectfully asserted that none of the cited references, either taken singly or in any combination, teach or suggest the following limitations recited in independent Claim 1:

a reference picture weighting factor assignor responsive to the relative positioning between the image block and first and second reference pictures indicated by the plurality of reference picture indices, the reference picture weighting factor assignor for calculating respective implicit weighting factors for the first and second reference pictures based on respective distances of the image block to the first and second reference pictures.

It is respectfully asserted that none of the cited references, either taken singly or in any combination, teach or suggest the following limitations recited in independent Claim 9:

calculating implicit weighting factors for the image block responsive to the relative positioning between the image block and first and second reference pictures indicated by first and second reference picture indices based on respective distances of the image block to the first and second reference pictures;

The Examiner has made the following correlations between the above-recited limitations of Claim 1 and Etoh, as set forth at page 2 of the Office Action:

a reference picture weighting factor assignor (22a, 22b) responsive to the relative positioning between the image block (input image to 22a and 22b via 21a and 21b, respectively) and first and second reference pictures indicated by the plurality of reference picture indices (23, 24), wherein the reference picture weighting factor

assignor determines respective implicit weighing factors for the first and second reference pictures (FIG. 5).

The Examiner has made the following correlations between the above-recited limitations of Claim 9 and Etoh, as set forth at page 4 of the Office Action:

> determining implicit weighting factors (22a, 22b, Fig. 5) for the image block responsive to the relative positioning between the image block (Input Image to 22a and 22b via 21a and 21b, respectively) and first and second reference pictures indicated by the plurality of reference picture indices (23, 24)

Nonetheless, in the case of both Claims 1 and 9, the Examiner has admitted that "Etoh does not particularly disclose calculating respective implicit weighting factors for the first and second reference pictures based on respective distances of the image block to the first and second reference pictures" (Office Action, pp. 3 and 5).

Accordingly, the Examiner has relied upon Tanaka as disclosing the preceding limitations the Examiner has stated are not disclosed in Etoh.

In particular, with respect to both Claims 1 and 9, the Examiner has stated "Tanaka et al teaches TV system conversion apparatus comprising motion vector detecting method, wherein the method comprises calculating respective implicit weighting factors (Fig. 6d-6f) for the first and second reference pictures based on respective distances (Fig. 6d, MV's in Horizontal and Vertical direction) of the image block to the first and second reference

pictures for preventing a deterioration in picture quality, thereby obtaining an improvement of picture quality by utilizing the motion-compensated interpolated signal (col. 7, lines 5-66)" (Office Action, pp. 3-4 and 9).

The Applicants respectfully disagree with the Examiner's reading of Tanaka and, further, respectively assert that Tanaka does not even remotely teach or suggest the preceding limitations of Claims 1 and 9.

The Applicants immediately hereinafter reproduce the cited textual sections of Tanaka for the Examiner's convenience.

Column 7, lines 5-58 of Tanaka disclose the following (emphasis added):

> Consequently, in the motion vector detection applicable to the apparatus according to the present invention, the motion vector v" corresponding to the aforesaid smallest interframe difference is not directly obtained from the total sum of those interframe differences, but is obtained from the product WnXDVn of the above total sum DVn multiplied by a necessary weighting factor Wn.
>
> FIGS. *6(d)* to *6(f)* show various examples of this weighting factor Wn. Particularly, FIG. *6(a)* shows an example in the situation where the comparatively large motion vector in the horizontal direction can be readily detected, as well as the small motion vector and the motion vector in the vertical direction can be hardly detected, so as to be applicable to the situation where it is required to detect the motion vector from the picture portion moving in the horizontal direction at a speed exceeding a certain speed.

FIG. *6(e)* shows another example in the situation where the comparatively large motion vector in the vertical direction can be readily detected, meanwhile FIG. *6(f)* shows still another example in the situation where both a comparatively large motion vectors in the horizontal and the vertical directions can be readily detected.

It is to be noticed that the weighting factor of the motion vector in the direction in which the motion vector can be readily detected in any of those situations as shown in FIGS. *6(d)* to *6(f)* should be small, meanwhile that in the direction in which the motion vector can be hardly detected should be large.

Next, an example of the circuitry including a signal selecting circuit 28 and a minimum value label detecting circuit 29 in FIG. 5, which is preferably applicable to the apparatus according to the present invention will be described hereinafter.

The improvement of picture quality obtained by the

motion-compensated interpolated picture signal:

It has been described hitherto that the interpolated picture signal required for obtaining the system conversion output picture signal is selected from the linear-interpolated picture signal and the plural motion-compensated interpolated picture signals, in response to the minimum of the absolute values of the interframe differences on the minimum of the total sums multiplied by the weighting factors of those interframe differences. However, when the interpolated

picture signal is se-lected as described above only with respect to the sample concerned in the picture, the picture quality deterioration such as so-called judder is occasionally caused, for instance, at the mutual connection contour between the linear-interpolated picture portion and the plural motion-compensated interpolated picture portions or between the plural motion-compensated interpolated picture portions themselves.

Thus, with respect to Figures 6d-f and column 7, lines 5-58 of Tanaka, i.e., the portions of Tanaka cited by the Examiner against the above recited limitations of Claims 1 and 90, Tanaka discloses that the weighting factor of a motion vector is smaller when in the direction in which the motion vector is more easily detected as compared to being larger when in the direction in which the motion vector is more difficult to detect. However, the cited portions of Tanaka do not even remotely teach or suggest "calculating respective implicit weighting factors for the first and second reference pictures based on respective distances of the image block to the first and second reference pictures" as recited in Claim 1, nor do they even remotely teach or suggest "calculating implicit weighting factors for the image block responsive to the relative positioning between the image block and first and second reference pictures indicated by first and second reference picture indices based on respective distances of the image block to the first and second reference pictures" as recited in Claim 9. For example, DIRECTION as disclosed by Tanaka does not correspond to DISTANCE as recited in Claims 1 and 9. Moreover, neither a DETECTION DIFFICULTY nor a DETECTION ABILITY as disclosed or suggested by Tanaka correspond to DISTANCE as recited in Claims 1 and 9.

It is to be noted that in the **Examiner's Answer**, the Examiner again relied upon the above-cited portion of Tanaka, stating "[b]y indicating Horizontal and Vertical directions, the prior art (Tanaka) refers to the components of the motion vector in X-axis and Y-axis, which are definitely defined as distances" (Examiner's Answer, p. 8). However, in each example provided in Figures 6d-6f of Tanaka (along with the corresponding text), it is clear that the direction component is used/considered by Tanaka and NOT distance. For example, the cited portion of **Tanaka does not even mention the word "distance" even once**, while continuously mentioning the word "direction". This is because the approach disclosed in Tanaka is direction-based and NOT distance-based. For example, in each of the examples respectively corresponding to Figures 6d-6f of Tanaka, it is clear that the weighting factor Wn of the motion vector Vn is small in the DIRECTION (direction component) in which the motion vector Vn can be readily detected and is large in the DIRECTION (direction component) in which the motion vector Vn can be hardly detected. Hence, to be more specific, the weighting factor determination approach in Tanaka is based on a capability of the motion vector being detected with respect to a given direction. Again, distance is not even mentioned once in the cited section of Tanaka with respect to weighting factor determination.

Thus, it is clear that the cited sections of Tanaka disclose that the weighting factor assignment is based on direction and a difficultly in detecting a motion vector, and NOT based on respective distances of the image block to the first and second reference pictures as essentially recited in Claims 1 and 9.

Etoh does not cure the deficiencies of Tanaka, and is silent with respect to the above-recited limitations of Claims 1 and 9. For example, as admitted by the Examiner as noted above,

"Etoh does not particularly disclose calculating respective implicit weighting factors for the first and second reference pictures based on respective distances of the image block to the first and second reference pictures" (Office Action, p. 3).

Thus, neither Etoh nor Tanaka, either taken singly or in combination, teach or suggest the above-recited limitations of Claims 1 and 9.

Accordingly, Claims 1 and 9 are patentably distinct and non-obvious over the cited references for at least the reasons set forth above. Therefore, withdrawal of the rejection and allowance of Claim 1 (and, thus, also Claims 3-8) and Claim 9 (and, thus, also Claims 11 and 13-14) is earnestly requested.

C. Conclusion

At least the above-identified limitations of the pending claims are not disclosed or suggested by the teachings of Etoh and/or Tanaka. Accordingly, it is respectfully requested that the Board reverse the rejection of Claims 1, 3-9, 11, and 13-14 under 35 U.S.C. §103(a).

In the event of any non-payment or improper payment of a required fee, the Commissioner is authorized to charge **Thomson Licensing Inc., Deposit Account No. 07-0832** as required to correct the error.

Respectfully submitted,

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